

# Nitrous Oxide Ethane Ethylene Engine, Phase I

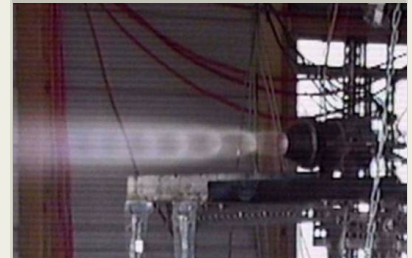
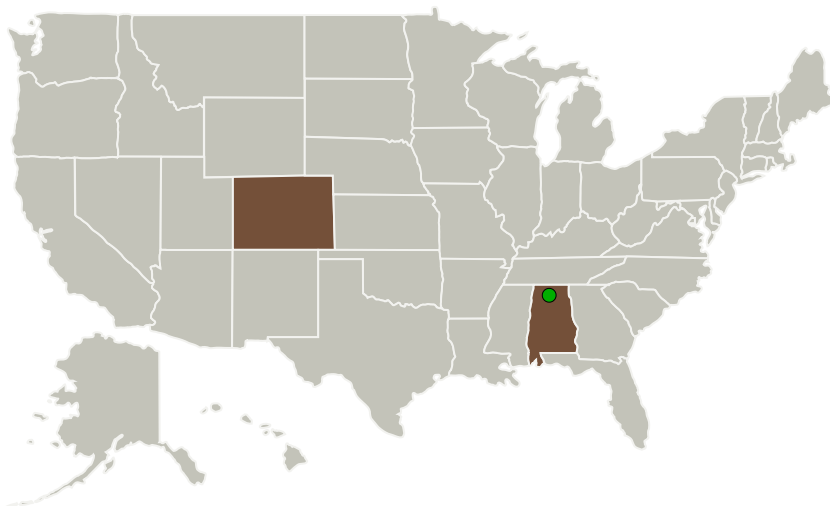
Completed Technology Project (2013 - 2013)



## Project Introduction

The Nitrous Oxide Ethane-Ethylene (NEE) engine is a proposed technology designed to provide spacecraft with non-toxic non-cryogenic high-performance propulsion. With the NEE engine, nitrous oxide is used as an autogenously pressurizing oxidizer, and a mixture of ethane and ethylene is used in the same manner as fuel. Initially, the ethane and ethylene mixture have the same vapor pressure as the nitrous oxide. By utilizing the autogenous pressurization capabilities of these propellants instead of an additional pressurization system greater system simplicity and reliability can be attained. Achievable specific impulse with pure N<sub>2</sub>O is about 315 s, which can be raised above 325 s by dissolving some O<sub>2</sub> in the N<sub>2</sub>O. Catalytic ignition can be achieved by using a ruthenium reactor to exothermically dissociate N<sub>2</sub>O. Since both propellants can exist as a liquid in the same temperature range, no thermal separation is required, and the two propellants can be stored together in compact common bulkhead tanks, and freezing is not an issue down to -90C. Pioneer Astronautics has demonstrated monopropellant nitrous oxide thrusters with a specific impulse of 190 s. Using such nitrous oxide monopropellant engines for low thrust RCS together with the NEE for TV and larger thrust reaction control propulsion, it will be possible to build spacecraft propulsion systems that are completely storable and non-toxic, with only two propellant fluids required. In the proposed program, we will demonstrate a NEE engine.

## Primary U.S. Work Locations and Key Partners



Nitrous Oxide Ethane Ethylene Engine

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Organizations Performing Work	Role	Type	Location
Pioneer Astronautics	Lead Organization	Industry Historically Underutilized Business Zones (HUBZones)	Lakewood, Colorado
● Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

## Primary U.S. Work Locations

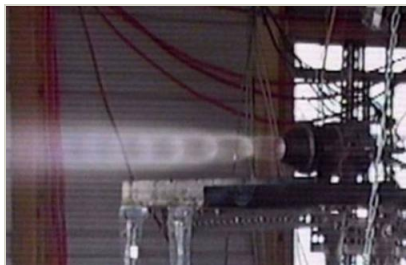
Alabama	Colorado
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## Project Transitions

**May 2013:** Project Start**November 2013:** Closed out**Closeout Documentation:**

- Final Summary Chart(<https://techport.nasa.gov/file/138358>)

## Images

**Project Image**

Nitrous Oxide Ethane Ethylene Engine

(<https://techport.nasa.gov/image/127141>)

## Organizational Responsibility

**Responsible Mission Directorate:**

Space Technology Mission Directorate (STMD)

**Lead Organization:**

Pioneer Astronautics

**Responsible Program:**

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

Carlos Torrez

**Principal Investigator:**

Robert M Zubrin

**Co-Investigator:**

Robert Zubrin

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## Technology Maturity (TRL)

Start: **3**  
Current: **4**  
Estimated End: **4**



## Technology Areas

### Primary:

- TX01 Propulsion Systems
  - └ TX01.1 Chemical Space Propulsion
    - └ TX01.1.2 Earth Storable

## Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System